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RE-EXAMINATION OF THE SOVIET ICBM PRODUCTION  
AND DEPLOYMENT PROGRAM CONSIDERED IN  
NIE 11-5-58

(ORR CONTRIBUTION TO GMIC)

CIA/RR MP-259

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24 October 1958

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RE-EXAMINATION OF THE SOVIET ICBM PRODUCTION  
AND DEPLOYMENT PROGRAM CONSIDERED IN  
NIE 11-5-58

I. FINDINGS.

1. We have no conclusive evidence that a Soviet ICBM production program of the type estimated in NIE 11-5-58 is currently being accomplished. In light of our current collection capabilities, however, we cannot preclude the existence of such a program since it would still be in its preliminary phases and at a low level of activity. Furthermore, there is fragmentary, though inconclusive, evidence which is consistent with the timing of the estimated program.

2. The full impact of the estimated program would not be felt until late 1959 or early 1960 at which time the implied magnitude of activity could hardly escape detection

3. We believe that the establishment of an early initial operational capability is almost certainly a Soviet objective. This would provide the USSR with the opportunity to test deployment concepts and the compatibility of all major elements of the system, to acquire a training facility, and in addition to obtain at an early date a distinct psychological advantage, although extremely limited military capability. Therefore, we believe that if the necessary decision was made in the early part of 1957, the USSR could now have or be very close to attaining this capability.

4. The date of decision to initiate series production would have to precede the delivery of production missiles to operational sites by at least eighteen months. In the case of the earliest program consistent with NIE 11-5-58 (i.e., initial delivery of production ICBMs in early 1959), this decision would have to have been made before the firing of the first ICBM at Tyuratam. Although we believe this earliest program could be accomplished with difficulty and might even be going on without our knowledge, we consider it to be the least likely of the three programs considered.

5. Although the estimated programs are feasible, they would require large and closely integrated efforts in near-minimum time periods. Any unanticipated major problems, therefore, could result in significant slippage in the program schedules.

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## II. DISCUSSION

This report re-examines selected aspects of the Soviet ICBM production and deployment program estimated in NIE 11-5-58. The discussion is presented in terms of the physical activities which should have occurred to date if the estimated program objective is to be met; the rate at which these activities should proceed in the future; the likelihood that evidence of these activities would be available, given current collection capabilities; and the evidence which has been received to date. A final section discusses some of the major decisions which the USSR would have to make in connection with this program and their implications.

The program selected for analysis is a two and one-half year production program which assumes that delivery of production ICBMs to completed launching facilities would begin in mid-1959, with attainment of an operational capability with 500 ICBMs at the end of 1961. These dates represent the mid-points of the time ranges given in NIE 11-5-58.\*

### A. Activities Which Should Have Occurred to Date.

To achieve the levels of output implied in our current estimate, activities should have occurred by now in many aspects of the program. We believe that pilot line production, facilities should be completed and operating, series production facilities should be nearing completion, subcontractors and suppliers should be in production, launching facilities should be in process, and troop training should be under way.

#### 1. Pilot Line Production Facilities.

Pilot line fabrication of research and development missiles, should have begun no later than early 1957, with fabrication of some components started during 1956. Following the initiation of the ICBM test flight program in August 1957 and incorporation into the missile of modifications indicated by the tests, R & D missile fabrication should have gradually increased. Sometime during 1958, fabrication of production prototypes of missiles and systems equipment should have

\* Although three alternative programs have been examined, the two programs representing the extremes of these ranges will be discussed only to the extent that they differ significantly from the two and one-half year program. These programs are outlined in more detail in the Appendix.

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been started and should now be well under way. A logical schedule of this activity would call for the production of several prototype ICBMs a month at present. These would be intended for development test firings, space vehicle adaptation, as well as delivery to ICG facilities.

## 2. Series Production Facilities.

~~Activities related to preparation for quantity production~~  
of ICBMs should also be well advanced. The majority of activity under way would still be related to preparation for initial production rather than production itself. Because of the relatively high peak rates of missile production necessary to meet future production requirements, it is probable that two large and separate plants would have been selected early in the planning of the program for manufacture of the ICBM airframe, final assembly of the missile, and factory test and checkout. These facilities, each with two to three million square feet of floor space, should by now have been either newly constructed or converted from other production. In addition, extensive production and proof-testing facilities for the necessary engines and guidance components of the missile should be available now.

Production tooling at these plants should now be in the final stages of installation, with manufacture of the first production ICBM about to be started. The labor force required for each of the plants would be building up in sufficient quantity to provide for initial deliveries of production ICBMs from each installation beginning in about July 1959. With these preparations for quantity production approaching completion, there would be an increasing volume of activity between production facilities and both the R & D pilot line installation producing prototypes and perhaps a thousand or more major and minor subcontractor facilities.

## 3. Subcontracting Facilities.

By the present time, subcontractors for the manufacture of all parts of the ICBM system should have been designated, interim production drawings furnished them, and initial production and shipment of parts and components begun. These facilities would probably still be engaged in shifting personnel and resources, increasing their tooling and making other adaptations and final production arrangements.

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A rapid expansion of output would be required of these plants in order to provide the working inventory of parts and components needed to permit a smooth and uninterrupted build up of ICBM production which would be programmed for 1959.

4. Launching Facilities.

Concurrently with all of these production activities, at least a moderate level of activity associated with preparations for future ICBM deployment should now be under way. Both the level and nature of this activity would depend on whether the Soviet ICBM system has been designed for hard (underground) launching sites, soft (surface) sites, semi-mobile rail launching facilities, or some combination of these deployment concepts. If fixed, hard sites are contemplated, preparation of several such facilities, possibly in widespread locations, should now be well under way, with most of the sub-surface construction phases completed. Installation of the necessary wiring, plumbing, storage tanks, and other facilities and equipment for these sites would probably be scheduled to begin shortly. The initial construction work for a number of other sites should be about to begin and the planning and surveying of virtually all sites contemplated in the program should be nearing completion. If, on the other hand, the USSR has chosen to adopt a static soft site ICBM system, site construction would probably be somewhat less advanced at the present time, since the construction effort required would be substantially less than in the case of underground launching facilities. In the event that mobile, rail-mounted launching unit system has been adopted, the principal activity to date would probably have been the partial conversion and adaptation of one or more rolling stock plants in the USSR to the manufacture of special purpose rail cars or the modification of cars requiring installation of electronic or other specialized equipment. Production or modification of these special rail units should currently be under way.

In order to receive the maximum benefit from an IOC facility, in terms of testing the capability of a complete prototype system, acquisition of experience in the operation of the system, and the possibility of obtaining an important psychological (although extremely limited military) advantage, the USSR should now have

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completed or be very close to completing preparation of an IOC site. Assuming that major technical difficulties have not been encountered, ICBM prototype production to date should have amounted to over 30 missiles. While some of these have already been fired, others are undoubtedly being prepared for test firing, and still others are probably being adapted for ESV or space flight purposes, the USSR should by now be in a position to allocate a small number of prototype missiles to an IOC program, some of which could have already reached a prototype launching facility.

5. Training Activities.

Preparation of operational launching facilities would be accompanied by a large-scale training program for military launching units, which should already have attained sizable proportions. Large numbers of officers and enlisted men should already be assembled at specialist schools, pilot line facilities, and other installations, probably including the Tyuratam test range, undergoing formal training in the wide variety of skills required for the operation of the Soviet ICBM system. Many of these personnel would probably have been transferred from other units experienced in the operation of shorter range missile systems. Training would also be under way at any operational sites which have already been completed.

B. Pace at Which Current Activities Should Proceed.

The activity which should already be under way in the early stages of all major aspects of the Soviet ICBM production and deployment program would have to be expanded very rapidly during 1959, reaching a peak rate in 1960.

1. Initial Operational Capability.

By late 1958 or early 1959 at the latest, the IOC site should be completed and turned over to the military user if the USSR is to obtain the maximum benefit from such a facility. Following user acceptance, manning and equipping of the facility, an intensive program of training and operational testing of the ICBM system on site would begin. Depending upon the location of the site and the degree of security which the USSR wishes to maintain regarding it, live test firings with prototype missiles might be expected to occur as part of this initial operational training and testing program.

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Throughout 1959, the scale and tempo of the ICBM production activity now under way should increase very sharply. By the end of the year, when the rate of production should have grown to about 10 ICBMs per month, the number of people directly or indirectly engaged in the ICBM production program would probably exceed 100,000. The number of production facilities directly involved to varying degrees would be in the hundreds and possibly over 1,000, with many of these facilities working multiple shifts. The total volume of activity would continue to increase until about mid-1960 and would be reflected by a rapid build up in the rate of ICBM production in the first few months of 1960 until peak production of over 30 missiles per month was achieved. Thereafter, the level of activity should remain fairly constant throughout the remainder of the program.

3. Proof Firing.

Sometime after mid-1959, there should occur the first of a regular and accelerating program of firing of production ICBMs, primarily for quality control purposes. These firings might take place at either Tyuratam or a training or IOC facility, and would probably continue throughout most of the remainder of the production program.

4. Deployment.

If the USSR has adopted a fixed, underground deployment concept, a sharp increase in activity relating to construction of launching facilities would occur, reaching a peak in late 1959 and early 1960. The expansion of this activity would roughly parallel the correspondingly sharp increase in production activity although preceding it by a few months. During the period of peak activity, probably 60,000 construction and installation workers would be directly engaged in ICBM site construction and preparation at about 35 separate and probably widespread locations. This activity would be accompanied by an extremely heavy flow of materials and equipment to these site locations. During late 1960 and throughout 1961, an average of well over two completed launching sites per month would be turned over to the military user.

If a soft, surface configuration has been adopted for Soviet launching facilities, both the level and tempo of construction activity

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would be much less than that required for construction of hard sites. Personnel, material and lead-time requirements would all be much smaller and, although the effort would still be sizable, even at peak rate probably less than 10 sites would be under construction at any given time. On the other hand, the activity associated with a semi-mobile rail system of deployment would take an entirely different form. By late 1959 and early 1960, an extensive program would be under way of construction of the railroad sidings or spurs which would serve as launching sites. These spurs would presumably be constructed in large numbers in order to increase the flexibility and decrease the vulnerability of the system. Simultaneously, production of a requirement of as many as 10-12,000 special purpose rail cars and locomotives would be in an advanced stage at one or more rolling stock plants. Most of these cars would be modified versions of standard railroad equipment and would represent only a small fraction of total Soviet output. The program's requirements for diesel switching locomotives and adapted and modified all-metal passenger cars of several kinds would amount to 50 percent or more of normal Soviet output of such equipment. There would also be an active program in process on installation of special equipment in rail cars intended for use in missile trains. During this period, there should be a steady increase in the number of guided missile trains moving into and within pre-selected launching areas, as well as a considerable volume of movement of special cars to and from factories and outfitting and supply centers.

5. Training.

Throughout 1959 and 1960, as the rate of completed missiles and sites increased rapidly, there would be a high and expanding level of training activities of many types. By 1960 probably well over 1,000 persons per month would be completing initial training, receiving assignments to operational units and taking over the operation of fully equipped, newly completed operational launching facilities.

6. Administration and Control.

The wide range of activity described above, all of which is essential to achievement of the Soviet ICBM capability by the end of 1961, would generate an exceptionally heavy and continuing flow of communications, travelers, materials, parts and equipment between

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industrial facilities, launching site areas, military and administrative organizations, and the central authority controlling the entire program. The inspection and acceptance procedures associated with delivery to the military of completed missiles, equipment and launching sites would alone require a high level of activity from late 1959 or early 1960 throughout the remainder of the program. Moreover, the administrative requirements of a program of this complexity and urgency would almost certainly result in an unprecedented amount of detailed reporting on the status of the program and on problems being encountered from widely separated installations throughout the Soviet Union to the central authority, which would be attempting to exercise rigid control over all major aspects of the integrated program.

C. Collection Capabilities.

As yet there is no conclusive evidence that a Soviet ICBM production and deployment program of the magnitude described has actually been initiated or that any of the activity anticipated to date has in fact taken place.

If the program is as estimated, we should expect about 5 sites to be currently under construction; by the end of 1959 about 4 sites should have been completed and another 25 should be under construction.

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D. Current Evidence.

The currently available evidence bearing on Soviet ICBM production and deployment consists primarily of fragmentary information on individual facilities and activities which indicate possible Soviet activity related to the pre-production phases of an ICBM program. There is limited information concerning a possible Soviet ICBM launching site, two possible prototype production facilities, and unidentified activity at several locations which might be associated with ICBM production. None of this evidence, however, is subject to interpretation as conclusively indicating ICBM production or deployment activity.

1. Deployment.

Fragmentary [ ] data concerning unidentified activity in the Polar Urals region suggests that establishment of an ICBM launching site might be under way. The available information, however, reveals only that a military construction project of undetermined scope and character was under way in the latter part of 1957 and is probably still continuing. [ ]

Railroad

construction battalions have also been active in the area [ ]

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2. Production.

Other information, similarly fragmentary in nature, permits some inferences to be drawn with respect to the location of two facilities possibly engaged in Soviet ICBM and space flight prototype production, as well as the possible timing of new programs at these facilities in the past. [REDACTED]

from 1953 through 1956 a sizable construction program was being undertaken at a known guided missile research and development facility in Bol'shevo, north of Moscow, and further that the facility was to be used for the development of long-range missiles. [REDACTED]

[REDACTED] Within five miles of the Bol'shevo facility is Plant No. 88, Kaliningrad, with a long history of ballistic missile development and prototype production activity and proven connections with the Bol'shevo facility [REDACTED]

[REDACTED] During 1955 and 1956, a 165 feet tall enclosed tower-like structure was constructed at Plant No. 88. Earlier in the history of this Plant a similar structure of smaller dimensions was built in the Plant area. Study of U.S. guided missile production practice indicates a need for this type of structure to fulfill vertical test requirements in final missile fabrication and checkout stages at the producing plant. This activity implies that prior to construction of the new structure in 1955 there were on the drawing boards missile hardware designs of a size greater than could be accommodated by the existing smaller tower. Anticipation of these new requirements could account for new construction and expansion at these two facilities. While there is no direct evidence that the ICBM program was involved, expansion of the facilities would have added substantially to prototype or pilot line production capabilities and

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cannot be accounted for solely on the basis of subsequent developments in the shorter-range ballistic missile programs. Similarly, it seems probable that the construction of the Tyuratam range, which also began in mid-1955, would not have been undertaken without at least a planning concept of the vehicles, presumably including the ICBM, to be launched. The timing of these events suggests that important decisions regarding an ICBM development program had already been made by the USSR prior to mid-1955.

There is tenuous evidence that activity in some way related to the ICBM and/or space flight programs might be under way at several Soviet cities, including Sverdlovsk, Kazan and Kuybyshev.

[REDACTED]

we cannot at present identify specific facilities in these cities with guided missile activities of any kind, nor can we determine whether the flights have been occasioned by missile development activity, an emerging missile production program, or both.

Considerably firmer evidence exists linking the city of Dnepropetrovsk and the former Dnepropetrovsk Automotive Plant to ballistic missile production activity, probably as early as 1951. Although this plant may well be a major Soviet producer of ballistic missiles, the evidence available on the plant's activity and status during the past several years is inadequate to determine whether any of this activity has been specifically in support of an ICBM program.

At the present time we have no direct evidence indicating that tooling or initial production has begun at the numerous subcontractor facilities or that final assembly plants have been converted or constructed.

[REDACTED] We believe, therefore, that the almost complete lack of conclusive evidence does not preclude the existence, in an early stage, of a program of the magnitude of the two and one-half year production program under consideration.

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Even if it is assumed that the USSR has encountered no major technical difficulties with its ICBM which would delay preparations for initiation of a quantity production program, accomplishment of the 500-missile program estimated for the end of 1961 might well be determined by the extent to which parts and components developed and tested at Kapustin Yar have been applied to the ICBM. A decision to rely heavily on equipment proven at Kapustin Yar could have been made as early as 1955 and would substantially reduce the difficulties that the USSR would encounter in fulfilling the estimated production and deployment program within the limited time period of two and one-half years specified.

A Soviet decision to establish an early IOC based on a prototype ICBM system, if made in early 1957 prior to flight testing of the entire missile, as we believe likely, would suggest that the USSR was prepared to initiate quantity production of the system in the event that the initial demonstrations proved satisfactory. Since the primary purpose of the IOC would be to examine the elements of the ICBM program in operation as a system and to acquire early experience and training with the missile system which should subsequently be available in quantity, the USSR would desire that the IOC prototype reflect as closely as possible the weapon system which will ultimately be deployed. An early IOC decision, therefore, would signify a considerable degree of confidence in the missile and system as it existed at that time. Moreover, it would signify Soviet recognition of the system concept in its missile program, with parallel planning, production and deployment of all elements of the ICBM and the equipment and facilities associated with it.

The lead-time requirements of the 500-missile production program would be so stringent that the decision to go into large-scale production would have had to be made no later than about November 1957, after the successful launching of Sputnik III, if an estimated target date of mid-1959 for delivery of first production ICBMs was to be met. This decision in late 1957 would have involved the acceptance of the basic ICBM design, including selection of the mode of deployment, and would have set in motion the pre-production phases of the program.

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The go-ahead on tooling at a host of facilities would have had to begin shortly after the successful ICBM firing at the end of January 1958. Implicit in the initiation of tooling would have been a decision with respect to the maximum rate of output to be provided for. This rate would probably have been established at a high level, which could be revised downward at any time in the future, if desired. A decision to tool only for a level appreciably below the maximum anticipated production requirement would deprive the USSR of a considerable element of freedom of future choice, because expansion of output beyond the level provided for in the original tooling of the production facilities could not be accomplished rapidly.

Although it cannot be determined whether the USSR has actually made the decision to initiate large-scale ICBM production without the further improvements in the missile which might result from additional testing, such a decision would strongly imply that it is an important objective of Soviet policy to acquire a militarily significant number of ICBMs at the earliest possible date. It would also imply that this had been a Soviet objective for some time, since achievement of a program of the magnitude estimated would be dependent, as indicated above, upon a series of major decisions which would have had to be made during the past two to three years. The magnitude of the resources which would already be committed to this program and allocated to it over the next several years, together with the risks involved in the commitment to a missile system which may not be fully proven as yet, would provide an indication of the significance of an early and sizable ICBM capability to the USSR if such a large-scale production program is actually under way. There could also be little doubt that the Soviet leaders had clearly determined the role to be played by long-range missiles in future Soviet military strategy.

Another basic and extremely important element of a Soviet decision to initiate quantity production of ICBMs would have been the concurrent decisions with respect to civilian and other military production to be sacrificed as a result of the new demands of the ICBM program. Even if entirely new industrial facilities were constructed for the specific purpose of final assembly of ICBMs, the program would have to be supported by hundreds of other major and minor sub-contractors and

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suppliers whose normal production activity would be disrupted to varying degrees by the requirements of this program. This entire range of decisions, moreover, would have had to be planned prior to the final decision, in late 1957 or early 1958, to initiate series production.

Because of the complexity of the ICBM production program and the number and diversity of industrial facilities which would have to participate in it, it is almost certain that these decisions would have been accompanied (or preceded) by the establishment of a single controlling authority in the USSR responsible for ICBM production. This action, in turn, would probably result in a transfer of all major and at least the principal minor contractors to the subordination of this central authority.

## 2. Future.

Having set in motion the vast and varied activities required from late 1959 on, the Soviet authorities would be confronted with two major identifiable areas in which there would be a continuing necessity for decisions throughout the program. One of these areas, in which exceedingly difficult decisions would have to be made repeatedly, would be whether and to what extent to modify the original goals of the program under way. These objectives would presumably be subjected to almost continual scrutiny and review in the light of any major problems encountered in the program itself, advances or delays in missile technology and in other weapons systems, changes in the Soviet view of U.S. capabilities and intentions, and continually changing internal and international conditions. Important new developments occurring during the course of the program would have to be considered by the Soviet leaders against their judgment of the relative advantage of continuing with a full-scale, top-speed program expected to result in a significant strategic capability before 1962; but with a weapon system conceived six or seven years earlier in a time of extraordinarily rapid technological progress.

The other major area of Soviet decision-making would arise in the day-to-day administration of the ICBM program. As production and delivery rates rise rapidly to a peak during 1960, it can be expected that a whole host of specific problems will arise, all requiring

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immediate decisions because of the time pressures and close integration of the entire program. These problems would be concerned with modifications and changes of design, deliveries, shipments, funds, schedules, quality control, inspection, personnel, rejects, shortages and a wide variety of other facets of the program. It seems highly probable that the result would be the referral of problems to central authority for urgent decision at a rate without precedent in any prior Soviet military or civilian peacetime program.

By early 1960, the estimated Soviet ICBM production and deployment program should have reached proportions unparalleled in size and urgency by any previous post-war military program in the USSR. At least the initial activity associated with it would necessarily have a clear priority over virtually all other military or economic activities for critical resources, facilities, and skilled manpower. This would be particularly essential during the most difficult production period, in late 1959 and early 1960, when output of the entire system would have to be increasing very rapidly to maximum program rates, if the objective is to be met. Once this build up had been achieved and production at peak rates sustained, the problems encountered should begin to decrease in both importance and frequency. Nevertheless, despite provision in over-all Soviet production scheduling of allowances for contingencies and reserves, the estimated program appears so tightly compressed in time that any major production problems might delay the entire program.

### 3. Alternative Programs.

When the 2½ year program discussed above is compared with programs which represent the extremes of the time spans estimated in NIE 11-5-58, it appears that the primary differences are in the degree of urgency involved and the timing of decisions. In order to begin deliveries of production ICBMs as early as the beginning of 1959 (the earliest date consistent with NIE 11-5-58), the Soviet decision to accept the basic ICBM design and to initiate series production would have had to be made several months before the first ICBM test firing of August 1957. Although this earlier program could be accomplished with difficulty and might even be going on without our knowledge, we consider that such a program is the least likely of the three alternatives.

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While recognizing the magnitude of economic effort required by the USSR to carry out such a program, we must reaffirm the conclusion of NIE 11-5-58 that the program lies within Soviet economic capabilities, provided the necessary major decisions were made early enough and the USSR considers the program of sufficient importance to assign to it the requisite priorities. It is virtually impossible to state that any given industrial program cannot be accomplished in a country possessing a large and varied industrial, material and population base such as that of the USSR. The ICBM program examined here, for example, would represent only a fraction of one percent of total Soviet economic activity. While it would unquestionably require a far larger share of the activity of certain key industrial sectors, and could account for as much as ten percent of Soviet military expenditures in 1960-61, the most difficult aspect of this program would probably be its pace and complexity, rather than its sheer economic magnitude. In our judgment, the USSR has the economic skills and resources to carry out this ICBM program, if it chooses to employ them for this purpose.

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Three alternative Soviet ICBM production and deployment programs have been examined which would result in the acquisition by the USSR of an operational capability with 500 ICBMs in 1961 or at the latest 1962. These are: first, a two-year production program which assumes a first operational capability with prototypes at the beginning of 1959 and attainment of 500 ICBMs by the beginning of 1961 -- the earliest dates consistent with NIE 11-5-58; second, a three-year production program which assumes a first operational capability with prototypes at the end of 1959 and attainment of 500 ICBMs by the end of 1962 -- the latest dates consistent with NIE 11-5-58; and third, a two and one-half year program which strikes a balance between these two extremes, with an initial operational capability with prototypes in mid-1959 and attainment of 500 ICBMs at the end of 1961 -- the mid-points of the ranges given in NIE 11-5-58.\*

An attempt has been made (see Figures 3, 4 and 5) to distinguish between several major and distinct kinds of activity which would have to occur in parallel or sequentially, in order for the USSR to achieve any of the three programs being examined. These are:

(1) System Demonstration and Evaluation

Apart from the principally R & D flight testing, this activity includes engineering tests of production prototypes to determine physical properties of the system as well as its producibility and maintainability. It also includes, at some point, service and troop tests by the user to evaluate the military suitability of the system.

(2) Pre-production

Pre-production activity begins with the nominal freezing of the design of the ICBM and systems equipment, and includes all of the subsequent activity which must occur in order to prepare for mass

\* There are, of course, many other possible alternatives such as an assumed very early initial operational capability coupled with a late attainment of 500 ICBMs, etc. The three programs chosen, however, are sufficient to illustrate the variations in kind and volume of activity required if a Soviet ICBM production and deployment program is proceeding as estimated in NIE 11-5-58.

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production of the system. It includes such activity as preparation of production data, including facilities requirements, procurement specifications, and interim and final production drawings, for all parts and components; the adaptation, rearrangement and tooling of production facilities; and the fabrication of production prototypes of missiles and systems equipment. The prototype period begins with the design release that permits fabrication of ICBMs and systems equipment patterned after those expected to be produced in quantity, and ends with the delivery of the last prototype equipment. The tooling period begins with the design of the production tooling and ends when this tooling has been proven by the production of the first of many acceptable units.

(3) Production

Production includes all activity associated with the actual manufacture and final assembly of parts and components of the ICBM and system equipment for deployment to operational units. It has three distinct phases:

(a) Start Up. The time from the beginning of manufacture of production tooling until delivery of the first production unit (excluding prototypes). It includes the lead-time for activating subcontractors, for building up the direct labor force in the prime and principal subcontractor facilities, and for building up a backlog of work in process to insure continuous increase in deliveries from first production to planned monthly rates of production.

(b) Build Up. Elapsed time between the delivery of the first production unit and the achievement of the peak planned monthly rate of production. Production units are identical, or at least substantially so. Minor modifications that do not change performance levels may be made during production. Major modifications cannot be made without delays in the build up.

(c) Production at Rate. Time between the achievement of the peak planned monthly rate of production and delivery of the last production unit covering the initial requirements

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for a given program.

(4) Deployment

This activity concerns placement in the field of the operational units (including training units) required for a given program. Preparation of launching sites includes site selection, surveying, and construction, installation of equipment, and delivery to the military user. Training includes off-site instruction of key individuals, cadres and teams, as well as on-site operational ICBM system training of troop units.

The accompanying charts and graphs illustrate the phasing through time of the various aspects of the three alternative ICBM programs selected for examination.

Figure 1 shows the cumulative delivery of the ICBMs to operational units required for each of the three programs.

Figure 2 shows the three curves as they would appear if each program were started at the same point in time (mid-1959).

Figures 3, 4 and 5 illustrate the time phasing of the principal categories of activity which would have to occur for each program to be achieved. The length of time shown for each type of activity is the minimum considered reasonable for programs of the scale being considered.

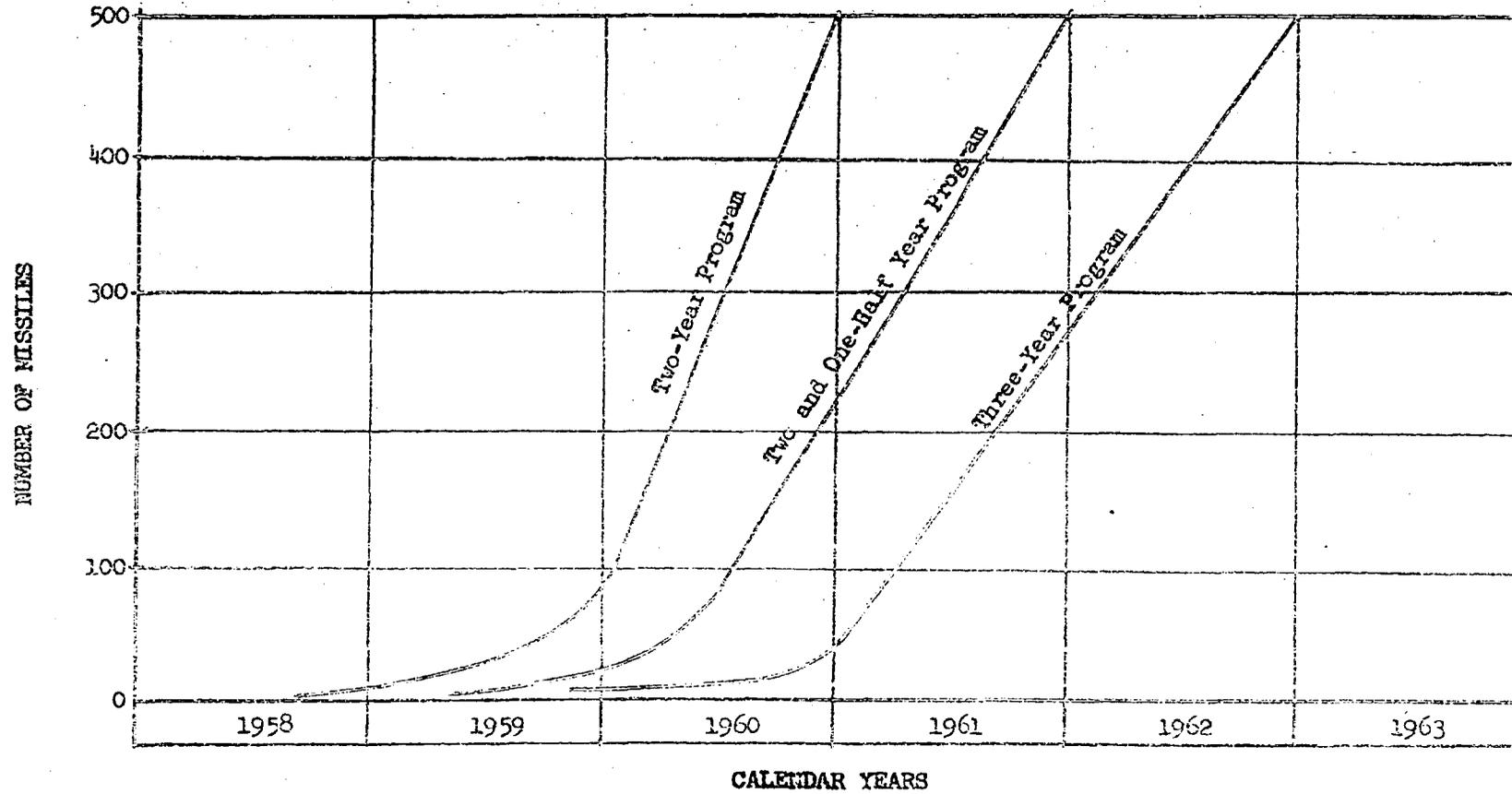
Figures 6, 7 and 8 present, for illustrative purposes, detailed scheduling by months of the production programs as they might develop over time to meet the indicated target dates. The numbers are not intended to be precise, but merely to suggest the rates at which activity would progress and the inter-relationships among activities.

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Figure 1

Deliveries of 500 Missiles to Operational Sites  
As Determined by the Three Production Programs\*  
(Figures are Cumulative)



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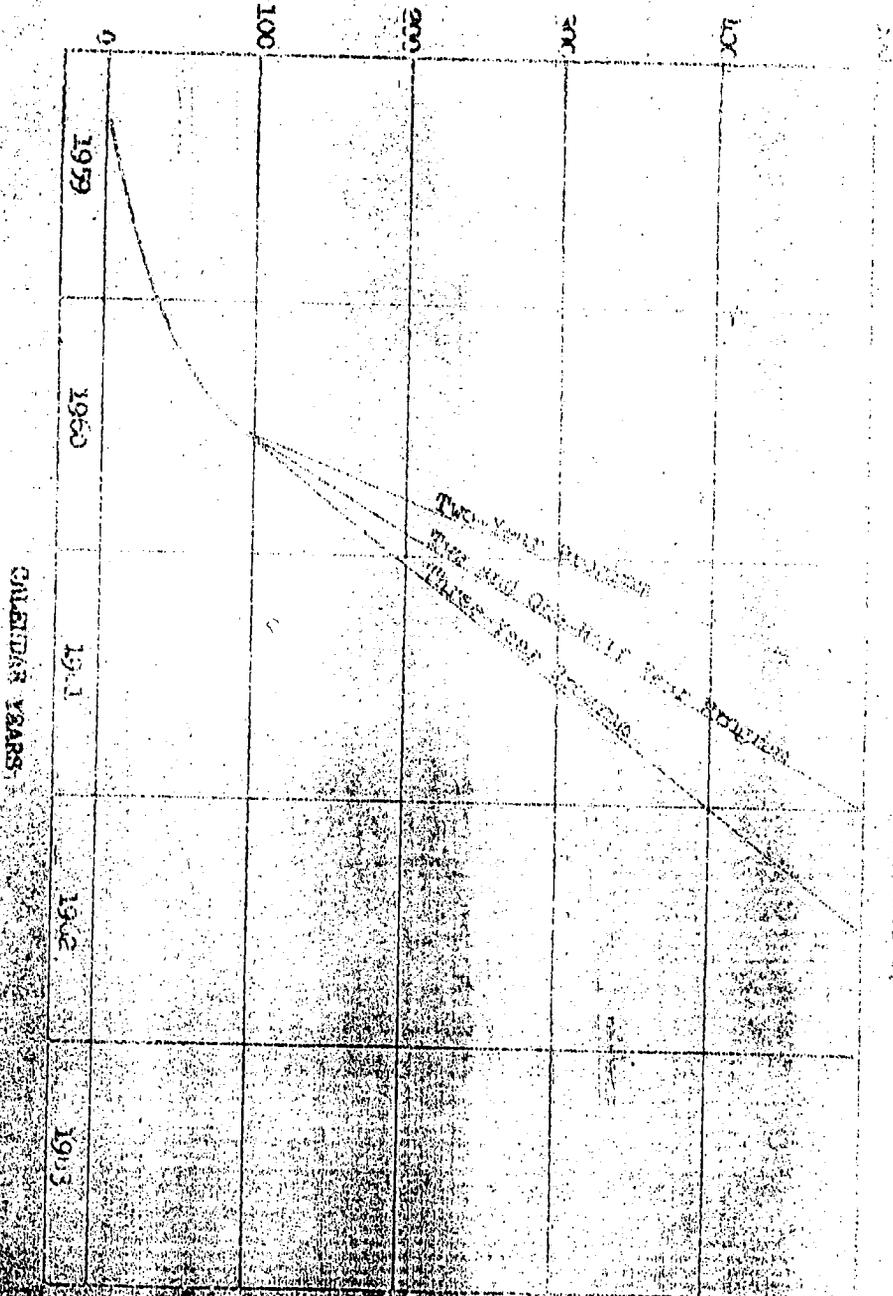
\* Quantities plotted are those occurring at the end of each time period.

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NUMBER OF MISSILES

Quantities plotted are those occurring at the end of each time period



(Source: The Department of Defense)

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PHASES OF DEVELOPMENT, PRODUCTION AND DEPLOYMENT  
(LOC at Beginning of 1959)

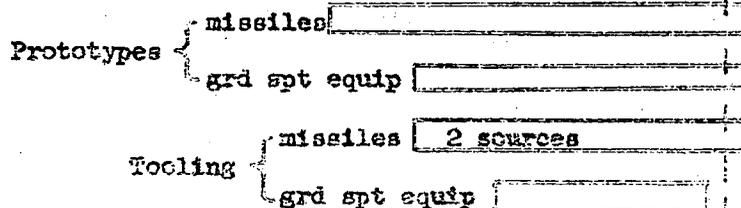
Figure 3

RESEARCH & DEVELOPMENT

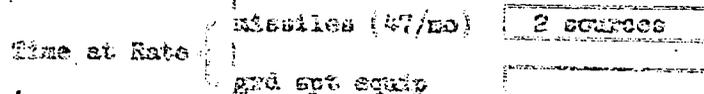
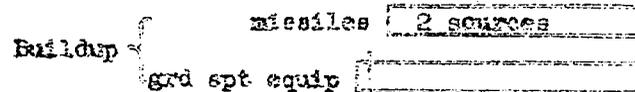
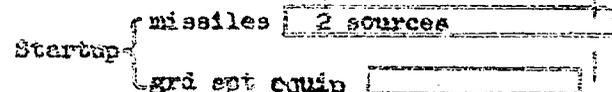
Study & Development

Demonstration & Evaluation

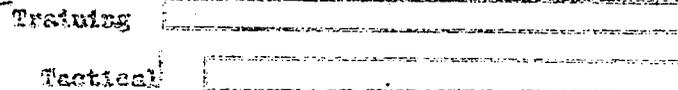
PREPRODUCTION



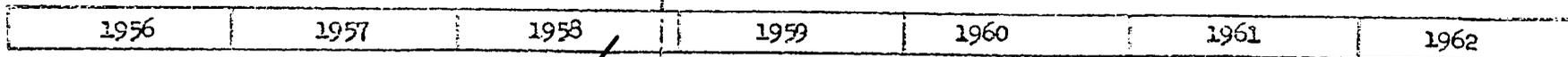
PRODUCTION



DEPLOYMENT



SITE CONSTRUCTION



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RESEARCH & DEVELOPMENT

Study & Development

Demonstration & Evaluation

PREPRODUCTION

Prototypes { Missiles [ ]  
                  { grd spt equip [ ]

Tooling { missiles 2 sources [ ]  
          { grd spt equip [ ]

PRODUCTION

Startup { missiles 2 sources [ ]  
          { grd spt equip [ ]

Building { missiles 2 sources [ ]  
          { grd spt equip [ ]

Time at Rate { missiles (31/mo) 2 sources [ ]  
                  { grd spt equip [ ]

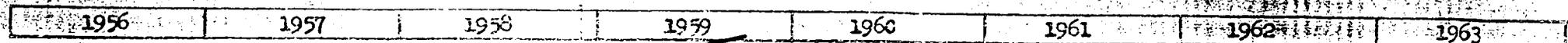
DEPLOYMENT

Training [ ]

Tactical [ ]

SITE CONSTRUCTION

Initiation { first [ ] last [ ]  
Completion { first [ ] last [ ]



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Figure 5

RESEARCH & DEVELOPMENT

Study & Development

Demonstration & Evaluation

PREPRODUCTION

Prototypes {  
missiles  
grd spt equip

Tooling {  
missiles 2 sources  
grd spt equip

PRODUCTION

Startup {  
missiles 2 sources  
grd spt equip

Buildup {  
missiles 2 sources  
grd spt equip

Time at Rate {  
missiles (25/mo) 2 sources  
grd spt equip

DEPLOYMENT

Training

Tactical

SITE CONSTRUCTION

initiation { first last  
completion { first last



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(NOT as Beginning of 1959)

	1957												1958												1959																
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M		
Operational Sites (Cum.) 1/																																									
Missile Deliveries to ICBM Sites (cum.)																																									
Total Missiles Produced (cum.)	1	2	3	4	5	6	7	9	10	12	15	18	19	21	23	25	29	33	37	41	45	49	53	58	63	70	77	85	100	116	136	163	199	240	289	336	383				
Missile Deliveries to ICBM Sites																																									
Production Missiles																																									
R&D & Preproduction Prototype Missiles 2/	1	1	1	1	1	1	1	2	1	2	3	3	1	2	2	3	4	4	4	4	4	4	4	4	5	5	7	9	9	12	16	20	27	36	43	47	47	47			
Other Allocations 3/																																									
Flight Test Program 4/																																									

Start of Production Buildup

Attainment of Peak Production Rate

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Illustration of Year Production Program  
to Acquire 500 Operational ICBMs  
(ICM at Beginning of 1959)

Figure 6  
(Continued)

	1960												1961											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Operational Sites (Cum.) 1/	18	21	27	31	39	42	45	48	49	49	47	45												
Missile Deliveries to ICBM Sites (cum.)	10	14	17	21	25	31	37	42	45	47	47	45												
Total Missiles Produced (cum.)	39	33	33	43	47	54	59	61	61	61	57	52												
Missile Deliveries to ICBM Sites	27	33	36	36	36	36	36	36	36	36	36	36												
Production Missiles	47	47	47	47	47	47	47	47	47	47	47	47												
R&D & Preproduction Prototype Missiles 2/																								
Other Allocations 3/	7	8	7	7	9	8	9	9	9	9	9	9												
Flight Test Program 4/	2	2	2	2	2	2	2	2	2	2	2	2												

↑ Attainment of Peak Production Rate

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- 1/ Sites are completed, including crews and equipment, in the month that first missiles are delivered. The site would then have an immediate, limited operational capability and would be considered fully operational (able to fire a full salvo) two-three months after first ICBM delivery.
- 2/ Because component testing is assumed to have previously taken place at Kapustin Yar, the R & D missiles are assumed to be used for system testing purposes.
- 3/ This category allows for missiles allocated for static and laboratory tests, production slippage, other degradation of all types and missiles expended for training purposes.
- 4/ It is assumed that the flight test program will increase to satisfy both development needs and to develop range and reliability data.

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Illustrative Two and One-Half Year Production Program  
to Acquire 500 Operational ICBMs  
(100 at Middle of 1959)

Figure 7  
(Continued)

	1960												1961														
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M
Operational Sites (Cum.) 1/	5	6	7	9	11	12	13	14	15	17	19	22	25	27	29	32	34	36	39	41	43	46	48	50			
Missile Deliveries to ICBM Sites (Cum.)	25	30	35	49	63	83	106	127	152	175	195	221	244	267	290	312	336	357	382	405	429	451	477	497			
Total Missiles Produced (Cum.)	115	131	151	178	205	240	271	307	333	364	395	426	457	487	517	532	557	602	643	674	705	736					
Missile Deliveries to ICBM Sites	5	5	8	11	14	20	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23			
Production Missiles	12	16	20	27	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31			
R&D & Preproduction Prototype Missiles 2/																											
Other Allocations 3/	2	2	2	3	4	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6			
Flight Test Program 4/	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2			

Attainment of Peak Production Rate

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